



**SCREENING SITE INSPECTION REPORT**

**SATRA CONCENTRATES, INC. (SATRA CO.)**  
**STEUBENVILLE, OHIO**  
**OHD 010 467 538**

**FINAL REPORT**

**Prepared for**

**U.S. ENVIRONMENTAL PROTECTION AGENCY**  
**Site Assessment Section**  
**77 West Jackson Boulevard**  
**Chicago, IL 60604**

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**SITE INSPECTION REPORT**



## **1.0 INTRODUCTION**

PRC Environmental Management, Inc. (PRC), was tasked by the U.S. Environmental Protection Agency (EPA) Region 5 to conduct a screening site inspection (SSI) at the Satra Concentrates, Inc. (Satra), site under Contract No. 68-W8-0084, Work Assignment No. 29-5JZZ.

### **1.1 PROJECT BACKGROUND**

The discovery date of the Satra site is listed in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) as June 27, 1988. The Southeast District of the Ohio Environmental Protection Agency (OEPA) performed a preliminary assessment (PA) of this property in July 1988. The report was prepared by Scott Bergreen of the Southeast District of OEPA.

PRC conducted a reconnaissance inspection at the Satra site on January 16, 1992. The reconnaissance inspection included an interview with a site representative and a walk-through inspection of the site. PRC reinspected the site on March 29, 1992. Based on the PA and the reconnaissance inspection, PRC prepared a site-specific implementation plan (SSIP) for the Satra site and submitted it to EPA for approval. EPA approved the SSIP on April 22, 1992. The sampling visit at the Satra site was conducted on April 28 and 29, 1992. During the sampling visit, a total of four residential well, 11 soil, seven sediment, two surface water, and one ground-water samples were collected.

### **1.2 PURPOSE**

The purposes of the SSI are to collect information concerning conditions at the Satra site to assess the threat posed to human health and the environment, and to determine the need for additional investigation under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). Specific objectives of the SSI are listed below.

- To collect data to evaluate sites using the Hazard Ranking System (HRS)
- To screen out sites that are not eligible for the National Priorities List (NPL) based on their HRS scores
- To identify sites that may require removal actions to address immediate threats to human health and the environment

The SSI is the first investigation performed to collect and analyze waste and environmental samples to support HRS scoring. Sampling locations are strategically chosen to identify hazardous substances present, determine whether contaminants are being released to the environment, and to determine whether targets have been exposed to site-related contaminants.

After the SSI, EPA, in consultation with state authorities, shall determine if the site should undergo further investigation (resulting in possible NPL consideration), or be designated "site evaluation accomplished" (SEA). The SEA designation means that, based on information available at the time of the SEA designation, no additional investigations will be conducted. However, if new site information is brought to EPA's attention, the site may be reevaluated. For sites warranting further investigation under CERCLA and SARA authority, an HRS scoring package may be prepared after the SSI if the resulting data is sufficient. Some sites will require an additional investigation (i.e., an expanded site inspection) to collect specific sampling data and target information sufficient to support an HRS score of 28.50 or greater needed for proposal to the NPL.

## **2.0 SITE BACKGROUND**

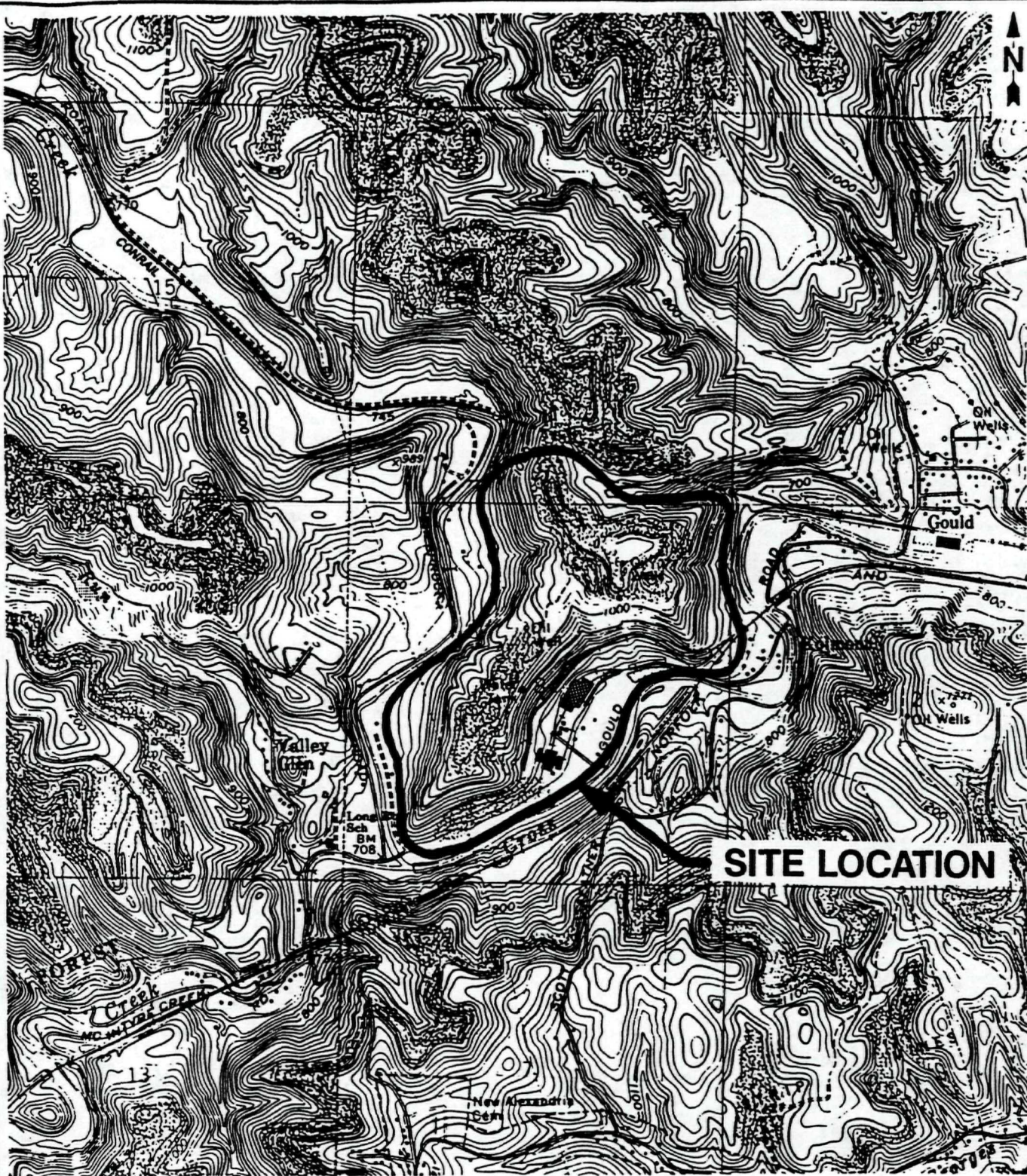
This section presents the site description, history, and current operations. Information in this section is based on the SSIP preparation, the site representative interview, and the site inspection.

### **2.1 SITE DESCRIPTION**

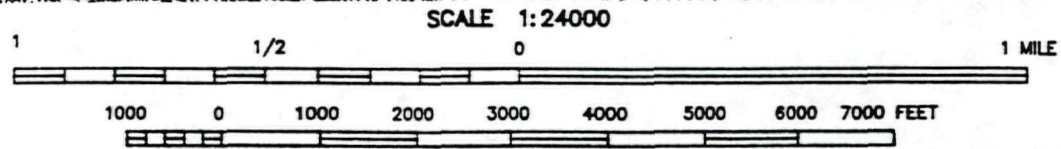
The Satra site is a 61-acre ferrochromium facility located on County Road 74 (Gould Road), Jefferson County, Ohio (Figure 1). The Satra site is located about 4 miles south of Steubenville and 2 miles east of Mingo Junction. Steubenville and Mingo Junction are both mixed residential and industrial areas with populations of 22,000 and 4,600, respectively (Census of Population and Housing, 1991). The nearest residence is about 1,000 feet northwest of the site. The area around the site is extremely rural, and a large number of industrial plants are located on the Ohio River west of the site.

There are two large buildings on site, Plant 1 and Plant 2. All operations take place in Plant 2; Plant 1 is idle (OEPA, 1987). An on-site water and sewage treatment plant treats sanitary wastewater before it is discharged to Cross Creek (PRC, 1992a). Three large waste piles from former operations lie northwest, south, and east of the plants. A chromium ore pile lies about 300 feet northwest of Plant 1. Figure 2 illustrates the site features.





**SITE LOCATION**



SCALE: 1" = 2,000'



QUADRANGLE LOCATION

SATRA CONCENTRATES  
STUEBENVILLE WEST, OHIO

**FIGURE 1**  
**SITE LOCATION**

**PRC** ENVIRONMENTAL MANAGEMENT, INC.

SATRA.DWG - 7/23/82 - RHN 030-002920

SOURCE: MODIFIED FROM USGS, 1968 STEUBENVILLE WEST, OHIO QUADRANGLE



NON- RESPONSIVE

The site is located on the floodplain of Cross Creek. Cross Creek empties into the Ohio River about 2 miles west from the site. Cross Creek is a recreational fishery that contains catfish, carp, whitefish, and small and large mouth bass (PRC, 1992b).

The bedrock geology of this area consists of alternating layers of sandstone, shale, and limestone in varying proportions. The geology at the Satra site is characterized by less than a few feet to more than 50 feet of unconsolidated sediments overlying bedrock. These valley fill materials consist of clay, silt, fine sand, coarse sand, and gravel. Area residents surrounding the Satra site obtain drinking water from a shallow sand and gravel aquifer that runs parallel to Cross Creek and an underlying shale bedrock aquifer (ODNR, 1957-1980). Other ground-water resources in the area include a shallow alluvial aquifer underlying the Ohio River, which is used as a drinking water source for the cities of Brilliant and Mingo Junction (PRC, 1992c).

Climate in the Steubenville area is classified as continental. Summer temperatures exceed 89°F an average of 16 days per year. Winters are cold and cloudy. An average of 40 inches of precipitation falls annually in this area, resulting in net precipitation of 4.9 inches (PRC, 1990).

## **2.2 SITE HISTORY AND OPERATIONS**

According to plant manager Louis Dipaolo, the site was originally owned by the Foote Mineral Company, which had merged with the Vanadium Corporation of America in 1970. Foote Mineral Company and the Vanadium Corporation of America have produced ferrovandium, ferrotitanium, ferrocolumbium, and ferroborean at other metal refining facilities. However, materials produced at the Satra site between 1970 and 1975 are unknown.

Satralloy bought the site from Foote Mineral Company in 1975. Satralloy manufactured alloy from chrome ore that was shipped to the site. The ore was smelted and refined in electric arc furnaces. The furnaces were shut down in December 1982. Between 1975 and 1982, large quantities of slag and baghouse dust waste were generated and dumped on site. About 100,000 tons of high-carbon slag, 700,000 tons of low-carbon slag, and 3,500 tons of baghouse dust were stockpiled from about 1975 to 1982. The total area of on-site waste disposal is about 61 acres (OEPA, 1987; USGS, 1968). Most of the waste has been deposited on unlined surfaces, without cover (PRC, 1992a).

The site changed names from Satralloy to Satra Concentrates, Inc., in November 1986 (OEPA, 1987). Satra recovers usable ferrochromium from existing piles of low-carbon slag waste using a water concentration process. A bulljig separates the metallic ore from the slag waste (OEPA, 1987). The slag is crushed and sent to a water clarifier, where a difference in specific

gravity separates alloy from spent slag. The recovered alloy is dried and shipped off site; the spent slag is sold as road aggregate. A sludge material is generated from this process and is disposed of in one of seven settling ponds on site.

Most of the wastewater from the water concentration process is recycled, but about 2 percent of the wastewater flows through a series of seven settling ponds. This untreated wastewater and surface runoff from the central eastern area of the site flow through an outfall ditch that leads to Cross Creek (OEPA, 1987). Another outfall ditch leading to Cross Creek drains runoff from the high-carbon slag pile in the northeast area of the site (see Figure 2).

Satra has a National Pollutant Discharge Elimination System (NPDES) permit (Permit No. OID00036\*CD). Three outfalls to Cross Creek covered by the permit are sampled monthly (Figure 2):

- Outfall 001 monitors sanitary discharge to Cross Creek after the discharge has been chlorinated and before it enters the creek.
- Outfall 003 monitors runoff from the high-carbon slag pile in the northeast area of the site.
- Outfall 004 monitors water concentration process overflow from the settling ponds and surface runoff from the central eastern area of the site.

According to monthly operating reports supplied to PRC by OEPA, hexavalent chromium at 0.021 micrograms per liter ( $\mu\text{g/L}$ ), total chromium at 0.112  $\mu\text{g/L}$ , and barium at 1.03  $\mu\text{g/L}$  have been detected at Outfall 004. These contaminants have also been detected at comparable levels at Outfall 003 (OEPA, 1991).

OEPA required that the sludge from the water concentration process be evaluated for Extraction Procedure (EP) Toxicity in 1986. Laboratory analysis detected chromium, cadmium, lead, and barium at levels too low for the sludge to be considered hazardous waste (Dipaolo, 1986).

### **3.0 FIELD OBSERVATIONS, SAMPLING PROCEDURES, AND ANALYTICAL RESULTS**

This section outlines field observations, sampling procedures, and analytical results at the Satra site. Individual subsections address the site representative interview and reconnaissance inspection, sample locations, and analytical results. Rationale for specific SSI activities are also provided. The SSI was conducted in accordance with the EPA-approved SSIP, dated March 20, 1992, and the EPA-approved generic quality assurance project plan (QAPjP), dated October 25,



1991. The EPA Potential Hazardous Waste Site Inspection Report (Form 2070-13) for the Satra site is provided in Appendix A.

### 3.1 RECONNAISSANCE INSPECTION

On January 16, 1992, PRC conducted a reconnaissance inspection of the Satra site. The reconnaissance inspection consisted of an interview with site representative Mr. Louis Dipaolo and a visual inspection of the site. The interview was conducted to gather information that would aid PRC in conducting SSI activities.

PRC conducted the visual inspection of the Satra site and surrounding area to determine appropriate health and safety requirements for conducting on-site activities and to make observations that would aid site characterization. PRC also evaluated the need for an immediate removal action and selected possible sampling locations during the visual inspection. PRC was accompanied by Mr. Dipaolo during the inspection. Photographs No. 1 through 9, taken during the visual inspection, are included in Appendix B.

The team observed the three outfalls covered by the NPDES permit. The creek water at Outfall 004 had a slight gray color. A milky pink material was discovered in sediments at Outfall 003 (see Photograph No. 2). PRC observed no signs of such discoloration at Outfall 001 (see Photograph No. 1).

The team observed wastewater discharging from the water concentration process (see Photograph 3). This wastewater flows from the process area through a drainage pipe into an open drainage channel; the water then flows through the seven settling ponds and discharges into Cross Creek (see Photograph Nos. 6, 7 and 8). According to Mr. Dipaolo, the ponds are dredged at least once a year, and the dredged mud is shipped off site. PRC did not observe sludge from the water concentration process during the site visit.

The PRC field team observed on-site waste. High-carbon slag is deposited south of Plant 2 and east of Plant 1. Low-carbon slag and chromium ore from previous operations are stored on a hill northwest of the plants (see Photograph No. 4). Baghouse dust is dispersed throughout the low-carbon slag piles and cannot be easily discerned (see Photograph No. 5). A dry magnetic recovery operation was recently put into effect on this hill.

Finally, PRC surveyed the site and neighboring properties to determine drinking water well sampling locations. A standby well is on site but does not supply drinking water (see Photograph No. 9). Site workers drink bottled water. Water from the on-site well is assumed to

be used for sanitary purposes.. A few of the residents drink bottled water and use well water for bathing and sanitary purposes. One resident reported that the well water had a sulfur taste and attributed this to strip mining in the area.

PRC revisited the site on March 29, 1992 to gather additional information on residential well use. During this reinspection, fishing was observed in Cross Creek at the Gould Road bridge downstream from the site. PRC also observed fishing in Cross Creek during the sampling visit, between Outfall 003 and Outfall 004 (see Photograph No. 10).

### **3.2 SAMPLING LOCATIONS**

PRC collected four residential well, 11 soil, seven sediment, two surface water, and one ground-water samples on April 28 and 29, 1992, at locations selected during the reconnaissance inspection (see Figure 3). Portions of each sample collected during the SSI were offered to and not accepted by the site representative.

Standard quality assurance and quality control (QA/QC) procedures for SSI field activities were followed during the collection of all samples. These procedures, including sample collection, packaging, shipping, and equipment decontamination, are documented in the EPA-approved generic QAPjP, dated October 25, 1991.

#### **3.2.1 Residential Well Samples**

Off-site residential well samples were collected to determine whether hazardous substances have been released from the Satra site to ground water. RW-1 and RW-4 were collected from residential wells hypothesized to be primary targets of potential ground-water contamination from the site. Wells RW-2 and RW-3 were originally selected as background wells for the sand and gravel aquifer and bedrock aquifer, respectively. During the sampling trip, PRC selected an alternative location for Well RW-3 because the well specified in the SSIP was no longer owned by the person contacted for permission to sample. Well RW-3 was later discovered to be screened in the sand and gravel aquifer and could no longer function as a background bedrock well location. Wells RW-1 and RW-2 are also in sand and gravel; RW-4 is in bedrock (see Figure 3 for residential well sampling locations).

RW-1 NON-RESPONSIVE

[REDACTED]

[REDACTED]

[REDACTED]



NON- RESPONSIVE

NON- RESPONSIVE

RW-4 NON- RESPONSIVE

The water from this well is not used for drinking, but is used for bathing and sanitary purposes (PRC, 1992a).

RW-3 NON- RESPONSIVE

A duplicate sample (RW-1D) was collected from sampling location RW-1. A field blank (FB-1) was collected and subjected to the same environmental conditions as other samples collected to ensure that proper QC procedures were followed during sample handling.

# NON- RESPONSIVE

### 3.2.2 Soil Samples

PRC collected four soil samples from the waste piles and the chromium ore pile to determine the potential for direct contact of hazardous substances by site workers and area residents. Five soil samples were collected from the drainage channel leading from Plant 2 and from other surface water runoff pathways to document the migration of hazardous substances

from on-site sources into Cross Creek. Two background soil samples were also collected (see Figure 3 for soil sampling locations and Appendix B for photographs of sampling locations).

SS-1, SS-4, SS-10, and SS-11 were collected from a baghouse dust pile, the chromium ore pile, the high-carbon slag pile south of Plant 2, and the low-carbon slag pile on top of the hill northwest of Plants 1 and 2, respectively (see Photograph Nos. 11 through 18, 22, and 23). These samples were collected to establish the presence of hazardous substances on site.

SS-8 and SS-9 were collected from the settling ponds leading from Plant 2 and discharging into Cross Creek (see Photograph Nos. 19, 20, and 21). SS-5 was collected from the outfall ditch leading from the high-carbon slag pile on the east side of the site to Outfall 003 (see Photograph Nos. 24 and 38). This sample was collected immediately south of the outfall ditch's confluence with a roadside ditch. SS-6 was collected from the roadside ditch about 6 feet upstream of the confluence with the outfall ditch (see Photograph No. 25). SS-7 was collected from the outfall ditch about 10 feet south of SS-5 (see Photograph No. 26).

Background samples SS-2 and SS-3 were collected from a hill west of Sheeprock Road and from a wooded area about 40 feet northeast of the Gould Road bridge, respectively (see Photograph Nos. 27 and 28). These samples were collected to establish a baseline for comparing potentially contaminated areas with unaffected areas.

### 3.2.3 Sediment Samples

PRC collected a total of seven sediment samples to document a release of hazardous substances to Cross Creek, a known fishery, from the Satra site. SD-2 was collected from Cross Creek upstream of its confluence with McIntyre Creek (see Photograph No. 41). SD-3 was collected about 230 feet west of Sheeprock Road in McIntyre Creek upstream of its confluence with Cross Creek (see Photograph No. 42). SD-4 was collected below the confluence of McIntyre Creek and Cross Creek, in a slow-moving zone along Cross Creek's north bank (see Photograph Nos. 39 and 40). SD-2, SD-3, and SD-4 were collected as background samples to verify that no other contamination is entering Cross Creek upstream of the site.

SD-6 was collected between Outfalls 004 and 001 (see Photograph No. 32). SD-7 was collected south of Outfall 003, about 30 feet downstream of the outfall ditch (see Photograph No. 30). SD-5 was collected about 28 feet upstream of SD-6 to identify where site contamination begins (see Photograph Nos. 34 and 35). SD-8 was collected from a slow-moving zone of Cross Creek, south of the Gould Road bridge, to determine if contamination had reached the fishery downstream of the site (see Photograph No. 29).

### **3.2.4 Surface Water Samples**

Two surface water samples were collected by PRC to verify surface water contamination. SW-1 was collected from Outfall 003; a duplicate sample (SW-1D) was also collected from this location (see Photograph No. 31). SW-1 was collected to document the release of hazardous substances from the water concentration process into Cross Creek, a documented fishery. SW-2 was collected from Outfall 004 (see Photograph No. 33). This sample was collected to determine whether hazardous substances from the high-carbon slag pile at the east end of the site and the waste piles on the hill northwest of the site are entering Cross Creek via overland migration.

### **3.2.5 Ground-Water Samples**

MW-1 was collected from the standby well on site to determine whether contaminants from the Satra site have migrated to ground water. Information concerning the well's depth and the aquifer in which it is screened was not available.

## **3.3 ANALYTICAL RESULTS**

Residential well, soil, sediment, surface water, and ground-water samples were analyzed through the EPA Contract Laboratory Program (CLP). All residential well, surface water, and ground-water samples were analyzed for full routine analytical services (RAS) parameters. Soil samples SS-1, SS-2, SS-8, and SS-9 were also analyzed for full RAS parameters. Sediment samples and all other soil samples were analyzed for RAS inorganic analytes and volatile organic compounds. All the substances analyzed for are included in the EPA Target Compound List (TCL) and Target Analyte List (TAL).

Significant findings of the residential well, soil, sediment, surface water and ground-water samples are presented in Tables 1, 2, 3, 4, and 5, respectively. A summary of all detected substances is provided in Tables 6, 7, 8, 9, and 10, respectively. EPA reviewed the results for compliance with the terms of the CLP and approved the data. PRC also evaluated the data for its usability and modified the reported results based on EPA auditor recommendations.

### **3.3.1 Residential Well Samples**

Residential well sample analyses do not indicate that hazardous substances have been released to ground water from the Satra site. Analysis of samples RW-2 and RW-4 showed elevated levels of barium and manganese at 825  $\mu\text{g/L}$  and 185  $\mu\text{g/L}$  in RW-2; and 1,150  $\mu\text{g/L}$  and 31.5  $\mu\text{g/L}$  in RW-4, respectively. RW-4 contained potassium at 5,120  $\mu\text{g/L}$ . However, barium,



**TABLE 1**  
**SIGNIFICANT FINDINGS OF RESIDENTIAL WELL SAMPLE ANALYSES**

SAMPLING LOCATION		RW-1	RW-1D	RW-2	RW-3	RW-4	FB-1
TIME		1255	1255	1200	1800	1145	1345
DATE		04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92
DEPTH (feet below the ground surface)		61	61	61	36	40	--
AQUIFER		Sand and Gravel	Sand and Gravel	Sand and Gravel	Sand and Gravel	Bedrock	--
CLP Organic Traffic Report No.		EOK20	EOK21	EOK22	EOK23	EOK24	EOK25
CLP Inorganic Traffic Report No.		92ZF90S01	92ZF90D01	92ZF90S02	92ZF90S03	92ZF90S04	92ZF90R01
APPEARANCE		Clear	Clear Duplicate of RW-1	Clear	Clear Background	Clear with sulfur odor	Clear
VOLATILE ORGANIC COMPOUNDS	CRQL						
acetone	5	ND	ND	ND	8	ND	ND
INORGANIC ANALYTES	CRDL						
barium	20	25.0	25.1	825	43.1	1,150	ND
potassium	750	ND	ND	ND	ND	5,120	ND
manganese	10	ND	ND	185	ND	31.5	ND
sodium	500	5,680	5,790	249,000	14,600	397,000	ND

**Notes:**

All concentrations in micrograms per liter (ug/L) unless otherwise noted.

CRQL = Contract-required quantitation limit

ND = Not detected

CRDL = Contract-required detection limit

**TABLE 2**  
**SIGNIFICANT FINDINGS OF SOIL SAMPLE ANALYSES**

SAMPLING LOCATION		SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10	SS-11
TIME		1050	1530	1450	1105	1450	1430	1440	1200	1300	1330	1125
DATE		04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92
DEPTH (inches below ground surface)		NA	0-8"	0-8"	NA	0-6"	0-6"	0-6"	NA	NA	NA	NA
CLP Organic Traffic Report No.		EQK01	EQK02	EQK03	EQK04	EQK05	EQK06	EQK07	EQK08	EQK09	EQK10	EQK11
CLP Inorganic Traffic Report No.		MERA01	MERA02	MERA03	MERA04	MERA05	MERA06	MERA08	MERA09	MERA09	MERA10	MERA11
APPEARANCE		Black Baghouse Dust	Black Silty Clay Background	Black Silty Clay Background	Coarse Black Ore	White Rocky Mud	Brown Sand/Pebbles	Gray Sand	Gray Silt	Gray Mud	Black Slag	Coarse Gray Slag
VOLATILE ORGANIC COMPOUNDS		CRQL										
acetone	10	17	11J	ND	ND	19	110	82	30	72	34	ND
SEMIVOLATILE ORGANIC COMPOUNDS		CRQL										
carbazole	330	ND	ND	NA	NA	NA	NA	NA	36J	ND	NA	NA
fluoranthene	330	970	24J	NA	NA	NA	NA	NA	600J	400J	NA	NA
chrysene	330	3,500	23J	NA	NA	NA	NA	NA	450J	320J	NA	NA
benzo[b]fluoranthene	330	2,300	ND	NA	NA	NA	NA	NA	540J	410J	NA	NA
benzo[a]pyrene	330	1,600	ND	NA	NA	NA	NA	NA	310J	250J	NA	NA
INORGANIC ANALYTES		CRDL										
cadmium	1	ND	ND	ND	ND	ND	1.88	2.18	ND	3.4	1.9	
calcium	1,000	6,360	8448	6,320	4,660	343,000	282,000	269,000	123,000	153,000	193,000	
chromium	2	12,400	27.7	115	1,110	28	49.2	134	1,850	1,410	1,990	3,000
copper	5	119	27.7	27.2	124	6.8 BJ	8.7BJ	9.0BJ	17.9J	21.9J	24.0J	15.9J
magnesium	2	176,000	3,140	2,530	39,400	8,660	8,060	5,850	42,000	37,000	56,000	46,600
mercury	0.1	1.0J	ND	ND	0.26J	ND	ND	ND	ND	ND	ND	0.16J
nickel	8	684	29.8	35.8	550	ND	ND	16.7BJ	35.2J	25.9BJ	44.5	84.8
sodium	1,000	1188	34.88	48.38	46.08	2388	1838	2138	2008	2108	2358	1148
thallium	2	1.8	0.52B	0.43B	ND	ND	ND	ND	0.44B	0.44B	0.62B	041B
zinc	4	3,560	94.3	135	18.9	21.2J	11.0J	71.8	180	207	237	457

**Notes:**

All organic compound concentrations are in micrograms per kilogram (ug/kg) unless otherwise noted.

All inorganic analyte concentrations are in milligrams per kilogram (mg/kg) unless otherwise noted.

CRQL = Contract-required quantitation limit

ND = Not detected

NA = Not available

CRDL = Contract-required detection limit

COMPOUND QUALIFIERS	DEFINITION	INTERPRETATION
J	Value is estimated.	Value may be semiquantitative.
ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
B	Value is real, but is above instrument detection limit and below CRDL.	Value may be semiquantitative.
J	Value is above CRDL and is an estimated value because of a QC protocol.	Value may be semiquantitative.

# **SIGNIFICANT FINDINGS OF SEDIMENT SAMPLE ANALYSES**

SAMPLING LOCATION		SD-2	SD-3	SD-4	SD-5	SD-6	SD-7	SD-8
TIME		1530	1550	1500	1300	1230	1045	1030
DATE		04/29/92	04/29/92	04/29/92	04/29/92	04/29/92	04/29/92	04/29/92
WATER BODY		Cross Creek	McIntyre Creek	Cross Creek	Cross Creek	Cross Creek	Cross Creek	Cross Creek
DEPTH (Inches below ground surface)		2 to 3	2 to 3	2 to 3	2 to 4	2 to 4	2 to 4	2 to 4
CLP Organic Traffic Report No.		EOK13	EOK14	EOK15	EOK16	EOK17	EOK18	EOK19
CLP Inorganic Traffic Report No.		MERA13	MERA14	MERA15	MERA16	MERA17	MERA18	MERA19
		Background	Background	Background				
VOLATILE ORGANIC COMPOUNDS		CRQL						
acetone	10	27	ND	ND	ND	ND	ND	ND
INORGANIC ANALYTES		CRDL						
calcium	5,000	13,800	21,400	56,700	13,200	106,000	17,300	9,570
chromium	10	13.6	15.4	16.7	29.5	327	24.4	16.8
magnesium	5,000	1,800	2,930	2,880	2,960	13,400	2,050	1,790

## **Notes:**

All organic compound concentrations are in micrograms per kilogram (ug/kg) unless otherwise noted.

All inorganic analyte concentrations are in milligrams per kilogram (mg/kg) unless otherwise noted.

CRQL = Contract-required quantitation limit

ND = Not detected

CRDL = Contract-required detection limit



**TABLE 4**  
**SIGNIFICANT FINDINGS OF SURFACE WATER SAMPLE ANALYSES**

SAMPLING LOCATION		SW-1	SW-1D	SW-2	FB-1	TB-1
TIME		1100	1100	1245	1210	0900
DATE		04/29/92	04/29/92	04/29/92	04/29/92	04/29/92
CLP Organic Traffic Report No.		EQK30	EQK31	EQK32	EQK33	EQK34
CLP Inorganic Traffic Report No.		MERA30	MERA31	MERA32	MERA33	MERA34
APPEARANCE		Cloudy	Cloudy	Cloudy	Clear	Clear
INORGANIC ANALYTES		CRDL				
aluminum	200	ND	8.68	276	ND	NA
arsenic	10	ND	ND	8.7BJ	ND	NA
barium	200	27.58	27.78	19.48	ND	NA
chromium	10	743	751	819	ND	NA
magnesium	5,000	60,700	62,000	9,970	ND	NA
manganese	15	8.68	9.28	47	ND	NA
potassium	5,000	6,240	6,140	15,700	ND	NA
sodium	5,000	29,000	29,800	23,000	337BJ	NA

**Notes:**

All concentrations are in micrograms per liter (ug/L) unless otherwise noted.

CRDL = Contract-required detection limit

ND = Not detected

NA = Not applicable

ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
B	Value is real, but is above instrument detection limit and below CRDL.	Value may be semiquantitative.
J	Value is above CRDL and is an estimated value because of a QC protocol.	Value may be semiquantitative.



**TABLE 5**  
**SIGNIFICANT FINDINGS OF GROUND-WATER SAMPLE ANALYSES**

SAMPLING LOCATION		MW-1 (Filtered)	MW-1D (Filtered)	FB-1 (Filtered)	TB-1 (Filtered)
TIME		1025	1025	1100	0900
DATE		04/28/92	04/28/92	04/28/92	04/28/92
DEPTH (feet below ground surface)		NA	NA	NA	NA
CLP Organic Traffic Report No.		EQK26	EQK27	EQK26	EQK29
CLP Inorganic Traffic Report No.		MERA26	MERA27	MERA26	MERA29
APPEARANCE		Clear	Clear	Clear	Clear
INORGANIC ANALYTES	CRDL				
magnesium	5,000	35,400	38,200	ND	NA
sodium	5,000	24,700	26,400	711B	NA

**Notes:**

All concentrations are in micrograms per liter (ug/L) unless otherwise noted.

CRDL = Contract-required detection limit

ND = Not detected

NA = Not applicable

ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
B	Value is real, but is above instrument detection limit and below CRDL.	Value may be semiquantitative.

**TABLE 6**  
**SUMMARY OF RESIDENTIAL WELL SAMPLE ANALYSES**

SAMPLING LOCATION		RW-1	RW-1D	RW-2	RW-3	RW-4	FB-1
TIME		1255	1255	1200	1000	1145	1345
DATE		04/28/02	04/28/02	04/28/02	04/28/02	04/28/02	04/28/02
DEPTH (feet below ground surface)		61	61	61	36	40	---
CLP Organic Traffic Report No.		EQK20	EQK21	EQK22	EQK23	EQK24	EQK25
CRL Inorganic Traffic Report No.		92ZF90S01	92ZF90D01	92ZF90S02	92ZF92S03	92ZF90S04	92ZF90R01
APPEARANCE		Clear	Clear Duplicate of RW-1	Clear	Clear Background	Clear with sulfurous	Clear
<b>VOLATILE ORGANIC COMPOUNDS</b>	<b>CRQL</b>						
acetone	5	ND	ND	ND	5	ND	ND
carbon disulfide	1	ND	ND	0.5J	ND	0.6J	ND
<b>TENTATIVELY IDENTIFIED COMPOUND</b>	<b>CRQL</b>						
unknown siloxane	NA	3J	ND	ND	ND	ND	ND
<b>INORGANIC ANALYTES</b>	<b>CRDL</b>						
barium	20	25.0	25.1	825	43.1	1,150	ND
calcium	500	114,000	116,000	90,800	166,000	45,800	ND
magnesium	500	19,800	20,200	19,700	34,300	10,100	ND
iron	100	ND	ND	353	140	199	ND
potassium	750	ND	ND	ND	ND	5,120	ND
manganese	10	ND	ND	185	ND	31.5	ND
sodium	500	5,680	5,790	249,000	14,600	397,000	ND

**Notes:**

All concentrations are in micrograms per liter (ug/L) unless otherwise noted.

CRQL = Contract-required quantitation limit

ND = Not detected

NA = Not available

CRDL = Contract-required detection limit

COMPOUND QUALIFIERS	DEFINITION	INTERPRETATION
J	Indicates an estimated value	Compound value may be semiquantitative.



TABLE 7  
SUMMARY OF SOIL SAMPLE ANALYSES

SAMPLING LOCATION		SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10	SS-11
TIME		1050	1050	1450	1105	1450	1450	1440	1200	1300	1330	1125
DATE		04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92	04/28/92
DEPTH (inches below ground surface)		NA	0-6"	0-6"	NA	0-6"	0-6"	0-6"	NA	NA	NA	NA
CLP Organic Traffic Report No.		EQK01	EQK02	EQK03	EQK04	EQK05	EQK06	EQK07	EQK08	EQK09	EQK10	EQK11
CLP Inorganic Traffic Report No.		MERA01	MERA02	MERA03	MERA04	MERA05	MERA06	MERA07	MERA08	MERA09	MERA10	MERA11
APPEARANCE		Black Baghouse Dust	Black Baghouse Clay	Coarse Black Ore Background	White Rocky Mud	Brown Sand/ Pebbles	Gray Sand	Gray Sil	Gray Mud	Black Slag	Coarse Gray Slag	
VOLATILE ORGANIC COMPOUNDS		CRQL										
acetone	10	17	11J	ND	ND	19	110	82	30	72	34	ND
toluene	10	ND	4J	ND	ND	ND	5J	ND	ND	ND	ND	ND
SEMI-VOLATILE ORGANIC COMPOUNDS		CRQL										
naphthalene	10	ND	51J	NA	NA	NA	NA	NA	ND	ND	NA	NA
2-methylnaphthalene	10	ND	116J	NA	NA	NA	NA	NA	ND	ND	NA	NA
dibenzofuran	330	55J	40J	NA	NA	NA	NA	NA	ND	ND	NA	NA
fluorene	330	ND	ND	ND	ND	NA	NA	NA	36J	ND	ND	ND
phenanthrene	330	860J	140J	NA	NA	NA	NA	NA	290J	290J	NA	NA
anthracene	330	ND	ND	NA	NA	NA	NA	NA	85J	ND	NA	NA
carbazole	330	ND	ND	NA	NA	NA	NA	NA	36J	ND	NA	NA
fluoranthene	330	870	24J	NA	NA	NA	NA	NA	800J	400J	NA	NA
pyrene	330	450J	24J	NA	NA	NA	NA	NA	300J	310J	NA	NA
benzo[a]anthracene	330	ND	ND	NA	NA	NA	NA	NA	300J	210J	NA	NA
chrysene	330	3,500	23J	NA	NA	NA	NA	NA	450J	320J	NA	NA
benz[e]pyrene	330	ND	ND	NA	NA	NA	NA	NA	ND	2,900	ND	ND
benzo[b]fluoranthene	330	ND	ND	NA	NA	NA	NA	NA	540J	410J	NA	NA
benzo[k]fluoranthene	330	550J	ND	NA	NA	NA	NA	NA	53J	170J	NA	NA
benzo[a]pyrene	330	1,600	ND	NA	NA	NA	NA	NA	310J	250J	NA	NA
indeno[1,2,3-cd]pyrene	330	580J	ND	NA	NA	NA	NA	NA	300J	230J	NA	NA
dibenz[a,h]anthracene	330	150J	ND	NA	NA	NA	NA	NA	71J	ND	NA	NA
benzo[g,h,i]perylene	330	330J	ND	NA	NA	NA	NA	NA	300J	240J	NA	NA
PESTICIDES/PCSS		CRQL										
alpha-BHC	1.7	ND	9.18JP	ND	ND	ND	ND	ND	ND	ND	ND	ND
delta-BHC	3.3	ND	ND	NA	NA	NA	NA	NA	1.5JP	ND	NA	NA
gamma-BHC	3.3	3.8JP	ND	NA	NA	NA	NA	NA	ND	ND	NA	NA
alpha-chlordane	1.7	ND	ND	NA	NA	NA	NA	NA	0.54JP	ND	NA	NA
INORGANIC ANALYTES		CRDL										
aluminum	40	16,400	11,200	11,700	3,540	671	1,110	2,000	15,200	15,000	19,000	14,000
antimony	12	ND	ND	ND	ND	21.68J	ND	ND	ND	ND	29.18J	ND
arsenic	2	29.0J	19.6J	10.6J	1.8J	1.25J	4.8J	2.5J	23.6J	21.2J	29.4J	17.7J
barium	40	78.8	74.8	105	14.58	77.48	43.58	68.68	82.28	79.28	105	42.68
beryllium	1	0.708	0.298	0.338	ND	ND	ND	ND	ND	ND	ND	ND
cadmium	1	ND	ND	ND	ND	ND	ND	1.88	2.18	ND	3.4	1.9
calcium	1,000	6,300	8448	6,320	4,800	343,000	282,000	289,000	123,000	153,000	153,000	193,000
chromium	2	12,400	27.7	115	1,110	29.9	48.2	134	1,850	1,410	1,880	3,000
cobalt	10	30.2	15.7	15.9	5.78	ND	ND	8.98	4.98	3.18	8.98	4.98
copper	5	119	27.7	27.2	124	8.98J	8.78J	9.08J	17.9J	21.9J	24.9J	13.9J
iron	20	23,000	38,000	30,500	13,100	428	781	3,570	7,870	6,820	7,840	3,680
lead	0.8	841J	35.0J	78.2J	4.1J	1.7J	5.6J	6.8J	35.4J	35.2J	45.6J	57.0J
magnesium	1,000	178,000	3,140	2,530	38,400	8,080	8,080	5,850	42,000	37,000	38,000	46,000
manganese	3	1,710	567	1,570	208	105	177	378	3,040	2,610	2,840	3,340
mercury	0.1	1.0J	ND	ND	0.26J	ND	ND	ND	ND	ND	ND	0.18J
nickel	8	894	29.8	35.8	350	ND	ND	18.78J	39.2J	25.98J	44.5	84.8
potassium	1,000	3548	1,320	1,850	3828	2828	ND	8588	1,150	1,020	1,4308J	5878J
selenium	1	ND	ND	0.328J	ND	ND	ND	ND	ND	ND	ND	ND
silver	2	1.88	0.908	ND	ND	ND	ND	ND	ND	ND	ND	ND
sodium	1,000	1188	34.88	48.38	48.08	2348	1838	2138	2008	2108	2338	1148
thallium	2	1.8	0.928	0.458	ND	ND	ND	ND	0.448	0.448	0.628	0.418
vanadium	10	31.5	20.9	25.1	6.48	4.18	15.18	6.78	57	35.3	38.7	38.7
zinc	4	3,580	94.3	135	18.9	21.2J	11.0J	71.8	180	207	237	457

Notes:  
All organic compound concentrations are in micrograms per kilogram (ug/kg) unless otherwise noted.  
All inorganic analyte concentrations are in milligrams per kilogram (mg/kg) unless otherwise noted.  
CRQL = Contract-required quantitation limit  
ND = Not detected  
NA = Not applicable  
CRDL = Contract-required detection limit

COMPOUND QUALIFIERS	DEFINITION	INTERPRETATION
J	Value is estimated.	Value may be semiquantitative.
P	This flag is used for pesticide and Aroclor compounds when there is a greater than 25% difference for detected concentrations between two gas chromatograph columns.	Compound value may be semiquantitative. There should be another analysis with a B qualifier, which is used.
	The lower of the two values is reported.	
ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
B	Value is real, but is above instrument detection limit and below CRDL.	Value may be semiquantitative.



**SUMMARY OF SEDIMENT SAMPLE ANALYSES**

SAMPLING LOCATION		SD-2	SD-3	SD-4	SD-5	SD-6	SD-7	SD-8
TIME		1530	1550	1500	1300	1230	1045	1030
DATE		04/29/92	04/29/92	04/29/92	04/29/92	04/29/92	04/29/92	04/29/92
DEPTH (inches below ground surface)		0 to 6	0 to 6	0 to 6	0 to 6	0 to 6	0 to 6	0 to 6
CLP Organic Traffic No.		EOK13	EOK14	EOK15	EOK16	EOK17	EOK18	EOK19
CLP Inorganic Traffic No.		MERA13	MERA14	MERA15	MERA16	MERA17	MERA18	MERA19
		Background	Background	Background	Background			
VOLATILE ORGANIC COMPOUNDS		CRQL						
acetone	10	27	ND	ND	ND	ND	ND	ND
toluene	10	ND	3J	ND	ND	ND	ND	ND
TENTATIVELY IDENTIFIED COMPOUNDS		CRQL						
disulfide, dimethyl	NA	9JN	320JN	130JN	ND	ND	ND	ND
methane, thiobis-	NA	ND	440JN	170JN	ND	ND	ND	ND
trisulfide, dimethyl	NA	ND	240JN	57JN	ND	ND	ND	ND
INORGANIC ANALYTES		CRDL						
aluminum	200	7,050	7,010	9,100	8,900	9,430	5,060	5,090
arsenic	10	6.9J	13.8J	8.3J	8.7J	7.6J	4.6J	6.4J
barium	200	82.9	73.8	117B	88.48	88.28	44.98	47.08
beryllium	5	0.72BJ	0.93BJ	1.2BJ	1.1BJ	0.87BJ	0.67BJ	0.66BJ
calcium	5,000	13,000	21,400	56,700	13,200	106,000	17,300	9,570
chromium	10	13.6	15.4	16.7	29.5	327	24.4	16.8
cobalt	50	11.08	22.2	14.7B	18.98	13.38	11.58	12.28
copper	25	14.7	19.6	20.4	19.5	16.3	9.6	11.0
iron	100	21,500	35,900	25,800	42,300	23,900	25,400	23,600
lead	3	12.7J	19.5J	17.4J	14.4J	22.5J	10.5J	15.6J
magnesium	5,000	1,800	2,930	2,880	2,980	13,400	2,050	1,790
manganese	15	1,500	1,420	1,050	1,470	1,600	771	767
nickel	40	19.6	40.0	27.5	32.2	26.9	21	21.2
potassium	5,000	985	848B	ND	1,550B	ND	ND	ND
sodium	5,000	216J	184J	374B	267J	377B	168J	162BJ
vanadium	50	15.08	17.2	19.7B	22.6	20.98	14.3	13.1
zinc	20	62.7	93.7	97.7	93.6	147	60.0	61.1

**Notes:**

All organic concentrations are in micrograms per kilogram (ug/kg) unless otherwise noted.  
 All inorganic analyte concentrations are in milligrams per kilogram (mg/kg) unless otherwise noted.  
 CRQL = Contract-required quantitation limit  
 ND = Not detected  
 NA = Not applicable  
 CRDL = Contract-required detection limit

COMPOUND QUALIFIERS	DEFINITION	INTERPRETATION
J	Value is estimated.	Value may be semiquantitative.
ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
B	Value is real, but is above instrument detection limit and below CRDL.	Value may be semiquantitative.
J	Value is above CRDL and is an estimated value because of a QC protocol.	Value may be semiquantitative.

**TABLE 9**  
**SUMMARY OF SURFACE WATER SAMPLE ANALYSES**

SAMPLING LOCATION		SW-1	SW-1D	SW-2	FB-1	TB-1
TIME		1100	1100	1245	1210	0900
DATE		04/29/92	04/29/92	04/29/92	04/29/92	04/29/92
CLP Organic Traffic Report No.		EQK30	EQK31	EQK32	EQK33	EQK34
CLP Inorganic Traffic Report No.		MERA30	MERA31	MERA32	MERA33	MERA34
APPEARANCE		Cloudy	Cloudy	Clear	Clear	Clear
<b>VOLATILE ORGANIC COMPOUNDS</b>	<b>CRQL</b>					
acetone	10	ND	ND	53	ND	18
chloroform	10	ND	ND	ND	ND	29
<b>TENTATIVELY IDENTIFIED COMPOUNDS</b>	<b>CRQL</b>					
cyclohexanol	NA	4J	4J	3J	ND	ND
cyclohexane, bromo--	NA	2JN	ND	ND	ND	ND
unknown alkanes	NA	ND	2J	ND	ND	ND
<b>INORGANIC ANALYTES</b>	<b>CRDL</b>					
aluminum	200	ND	8.6B	276	ND	NA
arsenic	10	ND	ND	8.7BJ	ND	NA
barium	200	27.5B	27.7B	19.4B	ND	NA
calcium	5,000	249,000	251,000	123,000	ND	NA
chromium	10	743	751	819	ND	NA
iron	100	215J	29.1BJ	166J	41.8BJ	NA
magnesium	5000	60,700	62,000	9,970	ND	NA
manganese	15	8.6B	9.2B	47	ND	NA
potassium	5000	6,240	6,140	15,700	ND	NA
sodium	5000	29,000	29,800	23,000	337BJ	NA
zinc	20	3.3BJ	ND	4.3BJ	8.5BJ	NA
cyanide	10	ND	10.3	ND	ND	NA

**Notes:**

All concentrations in micrograms per liter (ug/L) unless otherwise noted.

CRQL = Contract-required quantitation limit

ND = Not detected

NA = Not applicable

CRDL = Contract-required detection limit

COMPOUND QUALIFIERS	DEFINITION	INTERPRETATION
J	Value is estimated.	Value may be semiquantitative.
B	Value is also found in the associated blank.	Value may be semiquantitative.
<b>ANALYTE QUALIFIERS</b>	<b>DEFINITION</b>	<b>INTERPRETATION</b>
B	Value is real, but is above instrument detection limit and below the CRDL.	Value may be semiquantitative.
J	Value is above CRDL and is an estimated value because of a QC protocol.	Value may be semiquantitative.



# SUMMARY OF GROUND-WATER SAMPLE ANALYSES

SAMPLING LOCATION		MW-1 (Filtered)	MW-1D (Filtered)	FB-1 (Filtered)	TB-1 (Filtered)
TIME		1025	1025	1100	0900
DATE		04/28/92	04/28/92	04/28/92	04/28/92
Depth (feet below ground surface)		--	--	--	--
CLP Organic Traffic Report No.		EOK26	EOK27	EOK28	EOK29
CLP Inorganic Traffic Report No.		MERA26	MERA27	MERA28	MERA29
APPEARANCE		Clear	Clear	Clear	Clear
<b>VOLATILE ORGANIC COMPOUNDS</b>	<b>CRQL</b>				
acetone	10	10	7J	9J	12
chloroform	10	ND	ND	ND	31
<b>INORGANIC ANALYTES</b>	<b>CRDL</b>				
aluminum	200	45.2BJ	33.2BJ	ND	NA
arsenic	10	1.9B	ND	1.2B	NA
barium	200	26.1B	27.6B	ND	NA
calcium	5,000	174,000	191,000	66.3BJ	NA
copper	25	ND	6.6BJ	ND	NA
iron	100	ND	14.0BJ	14.0B	NA
lead	3	ND	ND	3.6J	NA
magnesium	5,000	35,400	36,200	ND	NA
manganese	15	140J	143J	ND	NA
potassium	5,000	2,800B	3,090B	ND	NA
sodium	5,000	24,700	26,400	711B	NA

## Notes:

All concentrations are in micrograms per liter (ug/L) unless otherwise noted.

CRQL = Contract-required quantitation limit

ND = Not detected

CRDL = Contract-required detection limit

NA = Not applicable

-- = Unknown

COMPOUND QUALIFIERS	DEFINITION	INTERPRETATION
J	Value is estimated.	Value may be semiquantitative.
ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
B	Value is real, but is above instrument detection limit and below CRDL.	Value may be quantitative or semiquantitative.
J	Value is above CRDL and is an estimated value because of a QC protocol.	Value may be semiquantitative.

potassium, and manganese were not detected at concentrations exceeding three times background in samples from the sand and gravel aquifer. Acetone was also detected in RW-2 but is not attributable to the site because it is a common laboratory contaminant and was detected in the trip blank. One tentatively identified compound (TIC) was detected in RW-1.

RW-2 and RW-4 contained concentrations of manganese and barium exceeding drinking water standards. RW-2 contained concentrations of manganese exceeding the primary regulations of 0.05 milligram per liter (mg/L), and RW-4 contained concentrations of barium exceeding the secondary regulations of 1.0 mg/L.

### **3.3.2 Soil Samples**

Soil sample analyses indicate that hazardous substances are present in on-site soils. A number of soil samples contained cadmium, chromium, copper, magnesium, nickel, and zinc at three times above background concentrations. These samples include cadmium in SS-7, SS-8, SS-10, and SS-11; chromium in all the samples except SS-5, SS-6, and SS-7; copper in SS-1 and SS-4; magnesium in SS-1, SS-4, SS-8, SS-9, SS-10, SS-11; nickel in SS-1 and SS-4, and zinc in SS-1 and SS-11. Chromium was detected at 12,400 milligrams per kilogram (mg/kg) in soil sample SS-1 (baghouse dust) and at 1,110 mg/kg in SS-4 (chromium ore pile). Chromium was detected at a higher concentration in the baghouse dust sample (SS-1) than in the chromium ore sample (SS-4), most likely because the baghouse dust contains a concentrated level of chromium, while the chromium ore contains a number of different metals. Several polynuclear aromatic hydrocarbons (PAH) are considered site contaminants because they were detected at concentrations above the CRQLs and were not detected in the background sample. Acetone was detected in all soil samples except SS-3, SS-4, and SS-11. Acetone is not suspected to be site-related because it is a common laboratory contaminant.

### **3.3.3 Sediment Samples**

Sediment sample analyses indicate that hazardous substances are present in the sediments in Cross Creek, a known fishery. Levels of calcium, chromium, and magnesium were detected in SD-6 at greater than three times the background concentrations. Chromium was detected at 327 mg/kg in SD-6, which was collected where wastewater from the water concentration process enters Cross Creek at Outfall 004. Calcium and magnesium were detected in SD-6 at 106,000 mg/kg and 13,400 mg/kg, respectively.

### **3.3.4 Surface Water Samples**

Surface water sample analyses indicate that hazardous substances are being released from the Satra site into Cross Creek. Chromium was detected in SW-1 at 743  $\mu\text{g/L}$ , in SW-1D at 751  $\mu\text{g/L}$ , and in SW-2 at 819  $\mu\text{g/L}$ . Aluminum, magnesium, potassium, and sodium were also detected in some of the surface water samples at concentrations above the contract-required detection limit (CRDL). Arsenic, barium and manganese were also detected in surface water samples but at concentrations below the CRDL.

### **3.3.5 Ground-Water Samples**

PRC collected one ground-water sample at the Satra site. Ground-water sample analysis indicates that relatively few hazardous substances are present in ground water. Magnesium was detected in MW-1D at 38,200  $\mu\text{g/L}$  and 35,400  $\mu\text{g/L}$  in MW-1. Sodium was also detected in MW-1D at 26,400  $\mu\text{g/L}$  and 24,700  $\mu\text{g/L}$  in MW-1.

## **4.0 PATHWAYS**

This section discusses the pathways and associated targets. The four pathways of concern are ground-water, surface water, soil exposure, and air.

### **4.1 GROUND-WATER PATHWAY**

Site geology consists of unconsolidated deposits beneath the flood plain of Cross Creek ranging from less than a few feet to more than 50 feet thick. These deposits consist of clay, silt, fine sand, coarse sand, and gravel. The bedrock beneath the entire basin consists of alternating layers of sandstone, shale, and limestone (ODNR, 1959).

The sand and gravel aquifer and shale bedrock aquifer supply potable water. Area topography indicates that ground-water flow is probably radial from the hill northwest of the plants; shallow ground water probably flows southeast along the creek valley. Residential wells RW-1 and RW-2 are both developed in sand and gravel at 61 feet bgs (ODNR, 1992b). RW-3 is also developed in sand and gravel at 36 feet bgs. RW-4 is developed in shale bedrock at 40 feet bgs. PRC could not determine the aquifer in which the standby well is developed. Appendix C presents well logs for these wells; Appendix D shows well locations.

The City of Steubenville obtains its drinking water from an intake on the Ohio River about 10 miles upstream of the site, and serves a population of 22,094 (PRC, 1992d). The cities



of Mingo Junction and Brilliant are supplied by wells located next to the Ohio River about 3 miles upstream and 4 miles downstream of the site, respectively (PRC, 1992c). The Mingo Junction wells serve a population of 4,600, and the Brilliant wells serve 1,672 people.

Based on well logs and conversations with the municipal water departments, PRC outlined the areas served by municipal systems on a U.S. Geological Survey topographic map of the site vicinity (see Appendix D). PRC estimated that 764 homes within 4 miles of the Satra site use private wells for their drinking water supplies (USGS, 1968). Based on a population density of 2.5 persons per household for Jefferson County (Census of Population and Housing, 1991), the total number of people drinking ground water within a 4-mile radius of the site is 1,910 people. The nearest residence relying on a private well is sampling location RW-1, about 1,000 feet west of the low-carbon slag piles on the east side of the site. A 4-mile radius map of the Satra site area is provided in Appendix D.

Analytical results do not indicate a release of site-related contaminants to ground water.

#### 4.2 SURFACE WATER PATHWAY

The Satra site is located in the flood plain of Cross Creek (FEMA, 1981). Overland drainage from the east portion of the site flows into a drainage ditch and discharges into Cross Creek. The west portion of the site is drained by the seven settling ponds, which also drain wastewater from the water concentration process.

The goal of the SSI was to evaluate the release of contaminants from on-site waste piles to Cross Creek, which is a recreational fishery. Surface water in Cross Creek and the Ohio River is not used for drinking water supplies within the 15-mile downstream target distance limit. Most residents located between 2 and 4 miles north of the site are served by the City of Steubenville's intake on the Ohio River, about 10 miles upstream from the site. An isolated wetland about 0.1 mile in length is located about 1,000 feet southeast of the high-carbon slag pile on the east side of the site (National Wetland Inventory, 1977). PRC does not suspect that the Satra site has affected this wetland.

Cross Creek is a potential surface water target for the Satra site, based on its documented use as a fishery. PRC observed fishing at the Gould Road bridge during a reinspection of the area on March 29, 1992, and directly in front of the site between Outfalls 003 and 004 during sampling activities on April 29, 1992.

Cross Creek enters the Ohio River about 5 miles east of the NPDES outfalls (USGS, 1968). Cross Creek and the Ohio River are used for recreational fishing. Cross Creek contains catfish, carp, whitefish, and small and large mouth bass (PRC, 1992b).

Chromium was detected in the outfall samples SW-1 at 743  $\mu\text{g/L}$  and SW-2 at 819  $\mu\text{g/L}$ . Chromium was also present in SD-6 at more than three times background concentrations. On-site sources contained concentrations of chromium at three times background. This suggests that the release of chromium into Cross Creek can be attributable to the Satra site.

#### **4.3 SOIL EXPOSURE PATHWAY**

The Satra site is easily accessible, allowing area residents to come into contact with hazardous substances. There are no houses, schools, day care facilities, or sensitive environments on or within 200 feet of suspected areas of surficial soil contamination. There are about seven workers on site. The nearest residence is located about 1,000 feet west of the low-carbon slag piles on the hill northwest of the plants. The resident population threat is low because the site lies in a rural setting. The estimated population within a 1-mile radius of the site is 437 people (USGS, 1968).

Heavy metals were detected at elevated concentrations in soil samples taken from the waste piles. Chromium, copper, lead, magnesium, nickel, and zinc were detected in on-site source samples at concentrations significantly above background. SS-1 was collected from the baghouse dust pile and contained 12,400 mg/kg of chromium.

PAHs were detected in soil samples taken from the settling ponds and from the baghouse dust pile. The source of the PAHs is not known, but because they were not detected in the background sample, they are considered to be related to site activities.

#### **4.4 AIR PATHWAY**

No odors or adverse health effects have been reported by nearby residents or workers. The baghouse dust pile northwest of the plants contains high concentrations of chromium and possibly could contaminate air. However, the resident population threat is low; the estimated population within a 1-mile radius of the site is 437 people (USGS, 1968). No odors or airborne particulates were observed during either the reconnaissance inspection or the sampling visit. In accordance with the EPA-approved SSIP, PRC did not conduct air monitoring during the SSI.

## 5.0 REFERENCES

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